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INDUSTRIAL WASTE SURVEY REPORT, MAY 20 TO MAY 27, 1953

Environmental Health Center
Cincinnati, Ohio

1953

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INDUSTRIAL WASTE SURVEY REPORT

Port Huron Sulphite and Paper Company
Port Huron, Michigan

May 20 to May 27, 1953

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U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
Public Health Service
Environmental Health Center
Cincinnati, Ohio

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SUPPLEMENTARY SECTION:
BLACK RIVER SURVEY: Following page 16

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I. GENERAL INFORMATION

1. Organization of Survey

This survey was a cooperative study conducted by the Port Huron Sulphite and Paper Company, Port Huron, Michigan, Michigan Water Resources Commission and the Environmental Health Center of the Public Health Service.

Analytical determinations were performed by Public Health Service chemists in a mobile laboratory located on the grounds of the Wayne County Sewage Treatment Plant at Wyandotte, Michigan. The Port Huron Sulphite and Paper Company aided personnel in becoming familiar with liquid waste sources, furnished personnel and materials for hydraulic works, and supplied certain pertinent data.

2. Dates of Survey

May 20 through May 27, 1953.

3. Purpose of Survey

This survey was conducted to determine the characteristics of the process wastes and the residual pollution load discharged to the Black River. This project was part of the continuing study of boundary waters pollution being conducted for the International Joint Commission.

4. Personnel Participating

PORT HURON SULPHITE AND PAPER COMPANY
- L. T. Summers, Technical Director
- Edw. Platzar, Asst. to Technical Director

PUBLIC HEALTH SERVICE
- D. M. Taylor, Public Health Engineer
- S. Soneda, Asst. Sanitary Engineer
- C. Shadix, Chemist
- S. Pinkoski, Chemist
- C. Hirth, Chemist
- P. Jones, Engineering Aide
- M. D. Currey, Laboratory Assistant

5. Location of Plant

This plant is located on the north bank of the Black River near the western edge of the city of Port Huron.

6. Raw Materials

The principal raw material is pulp, from both domestic and foreign sources. Additional raw materials include chlorine, filler, size, coloring materials, etc.

7. Production

This plant produces approximately 64 tons of high grade paper per day for specialty products. Such products include carbon paper, bleached tissue, white creping tissue, filter paper, special latex paper, and unbleached and black tag.

8. Operations

The plant operates 24 hours per day, 6 days per week.

9. Water Supply

Port Huron city water is used for sanitary purposes. St.Clair River water is used for process and cooling purposes. It is passed through pressure sand filters before use and consumption during the survey was about 8 MGD.

10. Sewers

Water-carried industrial wastes were being discharged directly to the Black River through 6 outfall sewers during the period of the survey. Sanitary wastes were discharged directly to plant sewers.

II. MANUFACTURING PROCESS

The process flow is shown in Figure 1.

11. Furnish Conditioning

A. Pulp Mixing

Purchased pulp laps are fed into mixers where the pulp is mixed with fresh water to separate the fibers and form pulp stock for paper making.

B. Bleaching

About 5000 tons of pulp are bleached annually. Pulp stock to be bleached is passed through bleach tanks in a two-step process. Bleach liquor is prepared by passing chlorine gas through milk of lime solution. The dilute pulp flows through two bleach tanks in series to a large vacuum drum filter. White water from the filter discharges to No.3 sewer.

Pulp stock from the vacuum filter then passes through a second large vacuum drum filter at the "tank farm." White water from this filter is reused for bleach makeup water with excess going to No.7 sewer. Concentrated pulp stock is pumped to storage in tanks, for feed to beaters.

C. Beaters

Bleached pulp from storage is fed to beaters where sizes, filler,

coloring matter, etc. are added. The thoroughly mixed furnish then passes to refiners.

D. Blending

Unbleached, mixed, dilute, washed, pulp stock is blended with mixed furnish from the beaters in Morden Refiners to form furnish for the paper machines.

E. Jordans

Furnish from the refiners passes through Jordans for further refining before going to the paper machines.

12. Paper Sheet Formation

The making of a sheet of paper on a paper machine involves dewatering of the furnish and the surface finishing of the sheet. The dewatering of the furnish must be accomplished in a manner that produces a sheet of uniform structure and thickness. It is done through the application, in combination, of natural drainage, induced drainage by partial vacuum, roll pressure, and heat. Surface finishing, in general, is accomplished by rolling friction. The initial forming of the paper sheets is done on either of two types of machines: Fourdrinier, or cylinder.

A. Fourdrinier Paper Machine

The Fourdrinier machine is characterized by the use of a traveling, endless, wire cloth, commonly designated as the wire, for the felting of the sheet. This wire is supported by tube rolls in such a way that the portion of it receiving the wet stock from a head box immediately preceding is traveling forward in a horizontal or nearly horizontal plane. In addition to traveling forward, the wire usually is given a sidewise motion or shake. This movement effects better intertwining of the fibers upon the surface of the wire as the water in which they are suspended drains through it. Removal of water from the forming sheet is hastened by the addition of suction boxes to the underside of the sheet-carrying portion of the wire.

By the time the sheet reaches the forward end of the wire, sufficient water has been removed from it so that it can support its own weight. At this point it is conveyed by means of woolen felts or blankets through a series of roll-type presses, which not only remove additional water from the wet sheet, but also compact it. The compacted sheet then passes to the drier section of the machine which is made up of a series of steam-heated, cast-iron cylinders.

After the drying of the sheet, it is necessary to improve its surface. This finishing operation is accomplished by passing the sheet through a vertical stack of horizontally positioned, highly polished, chilled cast iron rolls, known as the calender or calender stack.

B. The cylinder machine differs from the Fourdrinier machine principally in the manner of felting the sheet. Paper stock is placed in one or more vats. Partially submerged in each vat is a cylinder mold with a wire cloth surface. As the mold revolves, the sheet is felted to the wire cloth by the drainage of the water to the interior and from which it is discharged. The wet sheet thus formed is removed from the unsubmerged portion of the cylinder by means of an endless wooden felt or blanket, which also carries it through a series of squeeze rolls. Paper sheets of varying thickness and quality can be made by operating several cylinders in series and picking up all the paper sheets in series on a single felt, on which they are all compacted to form a single sheet.

Subsequent operations are the same as those for a Fourdrinier machine.

III. FRESH WATER USES

The principal fresh water uses are as follows:

1. Pulp breaker
2. Pulp washing after bleaching
3. Blenders
4. Jordans
5. Mixing boxes
6. Header box sprays
7. Wire and felt showers on paper machines

IV. WASTE SOURCES

The principal waste sources are as follows:

1. Waste bleach liquor
2. Waste wash water after bleaching
3. White water from paper machines (wire or cylinder, and couch pits)
4. Ash sluicing water (see sampling points and discussion of results)

V. WASTE REDUCTION MEASURES

The principal measures employed to reduce quantities of waste constituents released in process effluents are as follows:

1. Vacuum, rotary filter after bleaching to recover fiber. White water effluent passes to Sewer No. 3.

2. Vacuum, rotary filter after washing bleached pulp, to recover fiber. White water effluent is used partially as bleach liquor make-up.

3. White water from wire or cylinder, and couch pits is reused for beater make-up water and diluting furnish in mixing boxes ahead of paper machines.

4. White water, in excess of needs for beaters and mixing boxes, is passed through savealls. Recovered fiber is returned to furnish flow ahead of paper machines. Part of white water effluent is used for sprays and showers.

VI. SURVEY PROCEDURES

13. Sample Collection

Samples were taken at the following points during the period of the survey:

(1) Raw water line before treatment
(2) Sewer line No.8 outfall
(3) " " No.1 "
(4) " " No.3 "
(5) " " No.4 "
(6) " " No.7 "
(7) Flue ash wash sewer outfall

Figure 2 is a diagramatic layout, showing plant sewers with respect to waste sources, and the Black River.

Samples were composited as follows:

(1) Raw water - every hour over 8 hour period from 8 AM to 4 PM - equal increments.

(2) Sewer lines No. 8, 1, 3, and 4 every 20 minutes over 8 hour period from 8 AM to 4 PM - increments proportional to flow.

(3) Sewer line No. 7 - continuous sampling (automatic sampler) over 24 hours frum 4 PM to 4 PM - increments proportional to flow.

(4) Flue wash water every 20 minutes over 8 hour period from 8 AM to 4 PM - equal increments.

Liquid wastes from these sewers represented all those discharged from the plant.

The raw water was sampled for the purpose of obtaining net values for quantities of waste constituents discharged from plant operations.

14. Flow Measurements

Flow measurements, during the period of the survey, were as follows:

(1) Sewer lines No. 8, 1, 3, and 4 - wooden weir boxes were installed at the outfalls, in which sharp-crested, contracted, rectangular weirs were placed.

$$Q = 3.33 \ (L - 0.2H) \ H^{3/2} \ cfs$$

(2) A permanent steel weir box had been installed at the sewer line No. 7 outfall, in which a 5 ft., sharp-crested, contracted, rectangular weir had been placed.

(3) The flow in the flue ash wash sewer was estimated from water usage, because flow measurements were practically impossible.

15. Laboratory Analyses

The following laboratory determinations were made on the samples:

(1) Total solids
(2) Total volatile matter
(3) Suspended solids
(4) Suspended volatile matter
(5) B.O.D. - 5 day at 20° C
(6) pH
(7) Settleable solids - weight of solids settling out in 2 hours
(8) Settleable volatile matter

The procedures followed in making the determinations were according to those given in "Standard Methods for the Examination of Water and Sewage", 9th edition, with the exception of the settleable solids and settleable volatile matter. These latter determinations are empirical and designed to show results obtainable by 2 hours of settling. They were made by allowing samples to settle for 2 hours in glass cylinders (known volumes) and then running suspended solids and suspended volatile matter determinations on the supernatants.

VII. EXPLANATION OF ANALYSES

16. Biochemical Oxygen Demand

The biochemical oxygen demand of sewage, polluted waters, or industrial wastes, is the oxygen (in ppm) required during stabilization of the decomposable organic matter by aerobic bacterial action. The rate of oxygen demand is dependent on both time and temperature and consequently the standard conditions of 5 days' incubation at 20°C are usually used for the test. Approximately 68 per cent of the oxygen demand of the carbonaceous material present in normal domestic sewage is satisfied under the conditions of 5 days' incubation at 20°C. The oxygen demand rates of industrial wastes, however, may or may not follow the typical oxidation curve for domestic sewage. It would be necessary to incubate a particular sample of waste for such a period of time that no more oxygen demand was exerted, in order to determine the total B.O.D.

High BOD values are objectionalble from a stream pollution standpoint because they reduce the oxygen resources of the streams, adversely affecting aquatic life. If the oxygen is depleted, anaerobic conditions develope and the water is rendered undesirable for supply and recreational purposes.

17. Solids

Suspended solids are insoluble solids which float on the surface of the liquid, remain in suspension, or settle out on standing. They are determined by filtering samples through asbestos mats in Gooch crucibles. Total solids consist of all the solids in a sample which do not volatilize at 103°C or less. They include both suspended and dissolved solids. Volatile solids, or volatile matter, are those solids in the sample which are lost on ignition at a temperature of 600°C for 15 minutes.

Suspended solids cause water to appear turbid and unsightly. Settleable suspended solids are objectionable because they cause silting and sludge banks. Suspended solids are particularly objectionable in water supplies used for domestic and industrial purposes. Relatively large amounts of dissolved solids may be objectionable in domestic water supplies for physiological reasons, and in industrial water supplies for process reasons. The volatile solids (matter) results are obtained by an empirical method but they are intended to indicate the organic material content of the solids.

18. Settleable Solids and Volatile Matter

The settleable solids, determined in these studies, consisted of those solids settling out in a glass cylinder in 2 hours' time.

These empirical determinations were made for the purpose of estimating the amounts of solids which might settle out in a two hour period under quiescent conditions. Results indicate what might be accomplished in a settling basin or pond.

19. pH

The symbol "pH" denotes the negative logarithm of the hydrogen-ion normality. The pH value indicates the relative acidity or alkalinity of a solution, being lower with higher degrees of acidity.

pH data are helpful in measuring the effects of acid and alkaline wastes on natural surface waters. Acids causing pH values below 4.0 and alkalies causing pH values above 10.0 are undesirable and hazardous for fish life in waters which are not naturally so acid or alkaline. pH is also an important factor when considering treatment for domestic and industrial water supplies.

VIII. PRODUCTION

Paper production was reported in January 1953 to average 64 tons per day. Production figures during the period of the survey were as follows:

May 20	--	52.7 tons
May 21	--	23.3 tons
May 22	--	39.4 tons
May 26	--	56.7 tons
May 27	--	52.2 tons

A cyclone occurred in the plant vicinity on May 21 and production figures for May 21 and 22 were not normal because of power cut-offs. An average of the other three days would give a more normal value of 54 tons per day.

IX. DISCUSSION OF RESULTS

The daily and average, gross and net, concentrations and quantities of waste constituents discharged from the Port Huron Sulphite and Paper Company plant are shown in Tables 1 and 2.

Total waste constituents discharged from the plant are as follows:

Average, Net Total Plant Wastes

Waste Constituent	Sewers						
	No. 8	No.1	No.3	No.4	No.7	Pine Creek	Total
B.O.D.							
Lbs/Day	200	170	360	260	1900	2	2890
% of Total	6.9	5.9	12.4	9.0	65.7	0.1	100
Total Solids							
Lbs/Day	480	460	2370	730	4730	8740	17,500
% of Total	2.7	2.6	13.5	4.2	27.0	49.9	100
Total Volatile Matter							
Lbs/Day	220	300	1320	510	3220	3750	9,320
% of Total	2.4	3.2	14.2	5.5	34.5	40.2	100
Suspended Solids							
Lbs/Day	280	360	770	670	3740	7200	13,000
% of Total	2.2	2.8	5.9	5.2	28.8	55.4	100
Suspended Volatile Matter							
Lbs/Day	210	270	540	510	2880	3170	7,580
% of Total	2.8	3.6	7.1	6.7	38.0	41.8	100
Flow							
MGD	0.37	1.10	2.10	0.49	3.63	0.26	7.95
% of Total	4.6	13.8	26.4	6.2	45.7	3.3	100

On the basis of paper production during the period of the survey, average net quantities of waste constituents per ton of paper discharged from the plant are as follows:

Average Net Unit Quantities of Waste Constituents Discharged from Plant

Waste Constituent	Pounds Per Ton Paper: With Flue Ash Wastes	Without Flue Ash Wastes
BOD - 5 day	53.5	53.5
Total Solids	324	162
Total Volatile Matter	177	103
Suspended Solids	241	108
Suspended Volatile Matter	140	81.7
Flow-Gal./Ton Paper	147,000	142,000

Flue ash wastes are not normally considered as paper mill wastes but in this case they represent a large proportion of solids discharged to the Black River. They contribute only 3.3 per cent of the total volume but 55 per cent of the suspended solids. Laboratory data show that 98-99 per cent of these suspended solids are settleable in 2 hours under quiescent conditions.

Bleaching operations are usually considered to be part of pulp preparation. Bleaching wastes were not sampled separately. They are included in the results obtained from sewer No.3 which carries wastes from paper machine No.4.

Net suspended volatile matter may be taken as a measure of fiber losses. Exclusive of flue ash wash water the calculated fiber losses to process waste sewers are as follows:

Net Suspended Volatile Matter - Fiber Losses Based on Daily Paper Production of 54 Tons

Sewer Line	Per Cent Fiber Loss	Per Cent of Total Fiber Loss
No.8	0.20	4.9
No.1	.25	6.1
No.3	.50	12.2
No.4	.47	11.5
No.7	2.67	65.3
Total	4.09	100.0

Laboratory data indicated that a large proportion of the suspended solids could be settled out of the wastes under quiescent conditions (see description of determination under laboratory analyses). The results are as follows:

Average Settleable Solids Removal

Sewer Line	Per Cent of Suspended Solids	Per Cent of Total Plant Suspended Solids	Per Cent of Total Plant Settleable Solids
No.8	85	1.9	2.0
No.1	73	2.2	2.5
No.3	48	3.1	3.4
No.4	90	4.6	5.1
No.7	87	25.4	28.0
Flue Ash	99	53.4	59.0
Total		90.7	100.0

X. SUMMARY

This plant purchases its paper pulp from outside sources to produce high grade papers.

Liquid wastes are discharged from six sewers to the Black River. One sewer carries only ashes sluiced from the boiler house.

The average net, daily and unit quantities of waste constituents discharged from the plant are as follows:

Waste Constituent	Quantities: Total Lbs/Day, With Flue Ash Wastes	Quantities: Total Lbs/Day, Without Flue Ash Wastes	Quantities: Unit Lbs/Ton Paper, With Flue Ash Wastes	Quantities: Unit Lbs/Ton Paper, Without Flue Ash Wastes
BOD - 5 day	2,890	2,890	53.5	53.5
Total Solids	17,500	8,770	324	162
Total Volatile Matter	9,320	5,570	173	103
Suspended Solids	13,000	5,820	241	108
Suspended Volatile Matter	7,580	4,410	140	81.7
Flow - Million Gallons	7.95	7.69	0.147	0.142

Flue ash wastes are not normally considered as paper mill wastes but in this case they represent 50 per cent of the total solids discharged to the Black River. They contribute only 3.3 per cent of the total volume, but 55 per cent of the suspended solids.

Considering suspended volatile matter other than that from flue ash wastes to be fiber, the percentage fiber loss from the plant was 4.1.

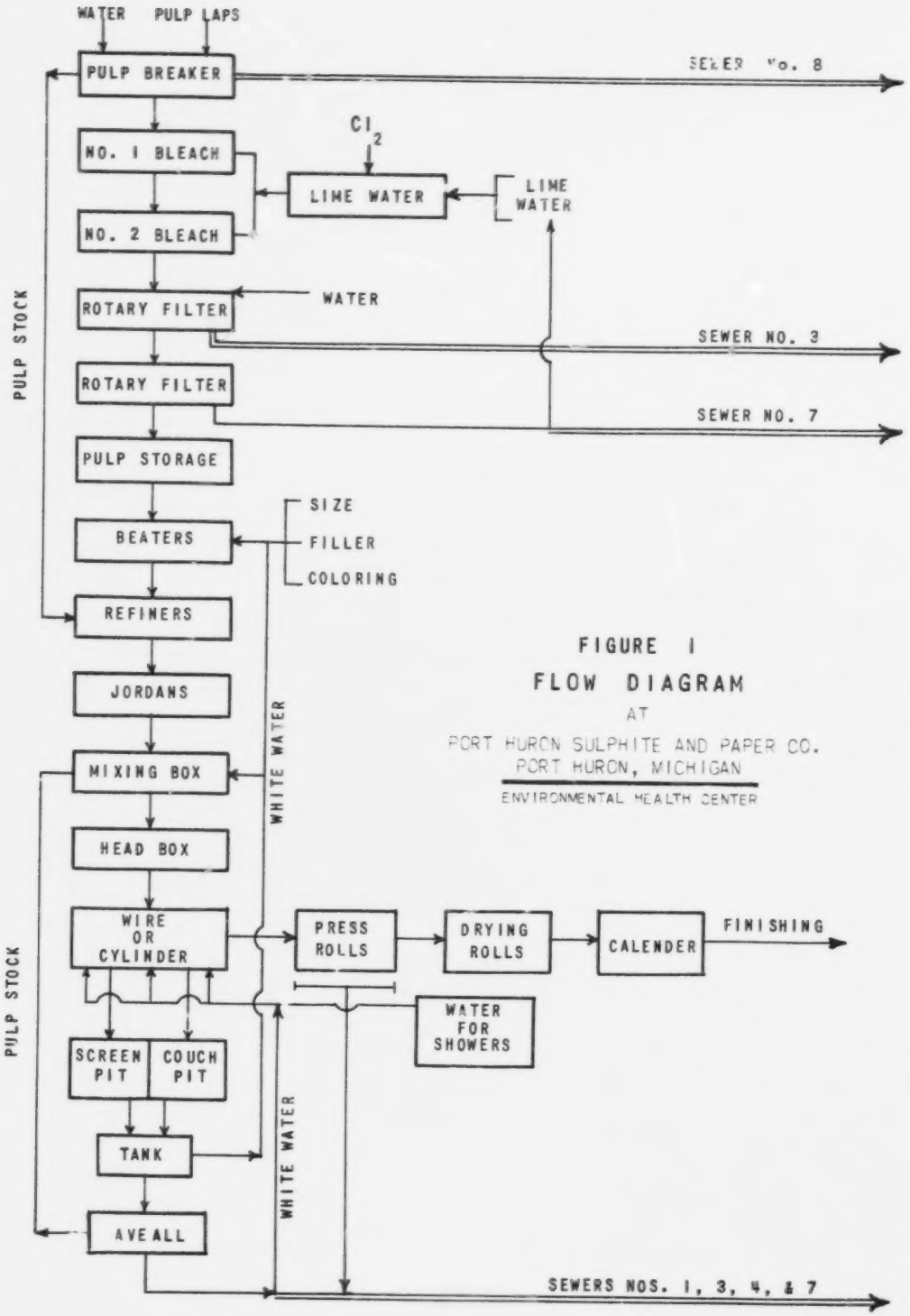

FIGURE 1

FLOW DIAGRAM

AT

PORT HURON SULPHITE AND PAPER CO.
PORT HURON, MICHIGAN

ENVIRONMENTAL HEALTH CENTER

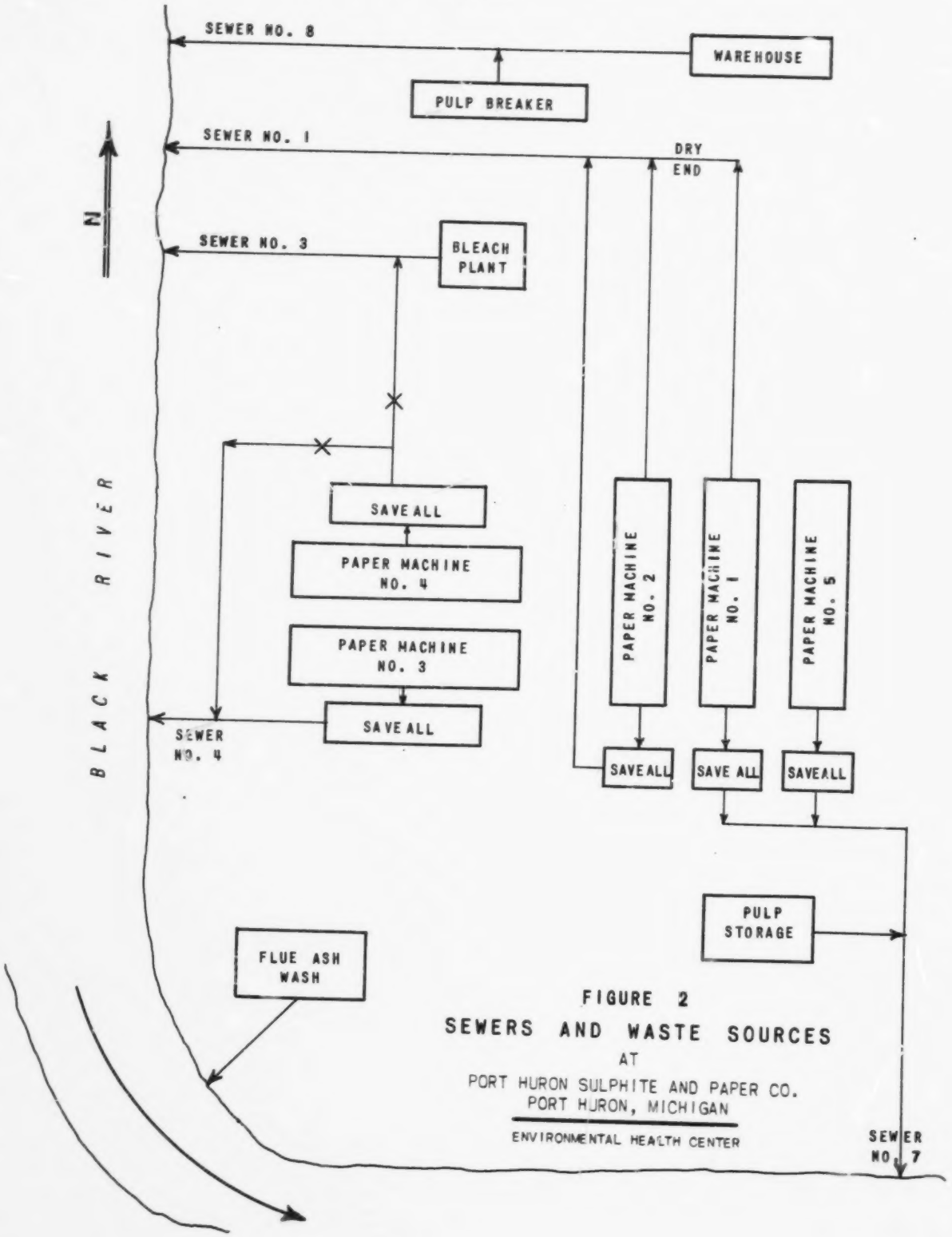

FIGURE 2

SEWERS AND WASTE SOURCES

AT

PORT HURON SULPHITE AND PAPER CO.
PORT HURON, MICHIGAN

ENVIRONMENTAL HEALTH CENTER

Environmental Health Center
Public Health Service
Cincinnati, Ohio

Table 1
AVERAGE AND DAILY, GROSS & NET CONCENTRATIONS OF WASTE CONSTITUENTS
PPM
Port Huron Sulphite and Paper Company, Port Huron, Michigan

Date 1953	Flow MGD	BOD 5-day 20°C ppm Gross	BOD 5-day 20°C ppm Net	Total Solids Total ppm Gross	Total Solids Total ppm Net	Total Solids Volatile ppm Gross	Total Solids Volatile ppm Net	Suspended Solids Total ppm Gross	Suspended Solids Total ppm Net	Suspended Solids Volatile ppm Gross	Suspended Solids Volatile ppm Net	Settleable Solids Total ppm Gross	Settleable Solids Total ppm Net	Settleable Solids Volatile ppm Gross	Settleable Solids Volatile ppm Net	pH
RAW WATER - 8 hr. composite																
May 20	8.86	1.17		118		43		5		3		(est. 2)		(est. 0.4)		8.0
21	8.87	0.65		133		60		7		2		4		0.6		7.8
22*	8.05	0.42		137		39		4		3		2		0.6		8.0
26	6.74	0.60		124		53		0.6		0		0		0		8.1
Ave.	8.13	0.71		128		49		4		2		2		0.4		-
Line #8 - 8 hr. composite																
May 20	0.430	54	53	267	149	99	56	76	71	59	56	66	64	63	62	7.5
21	0.373	94	93	328	195	147	87	140	133	89	87	120	116	113	112	7.7
22	0.327	58	58	320	183	156	117	126	122	115	112	106	104	96	95	7.5
26	0.336	49	48	263	139	108	55	66	65	55	55	54	54	52	52	7.7
27**	0.374	70	69	255	127	92	43	71	67	45	43	59	57	48	48	7.7
Ave.	0.368	65	64	287	159	120	72	96	92	73	71	81	79	74	74	-
Line #1 - 8 hr. composite																
May 20	1.33	13	12	168	50	75	32	43	38	32	29	29	27	24	23	7.6
21	1.13	22	21	186	53	85	25	34	27	26	24	19	15	16	15	7.5
22	1.05	10	10	188	51	72	33	55	51	25	22	49	47	14	13	7.6
26	0.926	32	31	190	66	98	45	52	51	47	47	40	40	38	38	7.7
27**	1.05	23	22	164	36	79	30	39	35	27	25	28	26	16	16	7.7
Ave.	1.10	20	19	179	51	82	33	45	40	31	30	33	31	22	21	-
Line #3 - 8 hr. composite																
May 20	3.06	21	20	196	78	80	37	45	40	32	29	24	19	20	19	7.4
21	3.07	22	21	196	63	51	0	34	27	25	23	6	2	6	5	7.7
22	2.31	23	23	440	303	260	221	49	45	35	32	27	25	13	12	7.4
26	0.912	21	20	364	240	200	147	88	87	54	54	52	52	30	30	7.5
27**	1.17	18	17	186	58	78	29	68	64	36	34	47	45	15	15	7.6
Ave.	2.10	21	20	276	148	134	87	57	53	36	34	31	29	17	16	-

Table 1 (Cont'd) - 2

AVERAGE AND DAILY, GROSS & NET, CONCENTRATIONS OF WASTE CONSTITUENTS PPM

Environmental Health Center
Public Health Service
Cincinnati, Ohio

Port Huron Sulphite and Paper Company, Port Huron, Michigan

Date 1953	Flow MGD	BOD 5-day 20°C ppm Gross	BOD 5-day 20°C ppm Net	Total Solids Total ppm Gross	Total Solids Total ppm Net	Total Solids Volatile ppm Gross	Total Solids Volatile ppm Net	Suspended Solids Total ppm Gross	Suspended Solids Total ppm Net	Suspended Solids Volatile ppm Gross	Suspended Solids Volatile ppm Net	Settleable Solids Total ppm Gross	Settleable Solids Total ppm Net	Settleable Solids Volatile ppm Gross	Settleable Solids Volatile ppm Net	pH
Line #4 - 8 hr. composite																
May 20	0.475	82	81	354	236	220	177	224	219	180	177	217	215	178	177	6.8
21	0.464	62	61	292	159	160	100	180	173	102	100	162	158	101	100	7.7
22	0.476	46	46	277	140	159	120	144	140	123	120	128	126	113	113	7.2
26	0.481	79	78	378	254	226	173	202	201	173	173	192	192	173	172	7.2
27**	0.540	57	56	242	114	114	65	100	96	67	65	70	68	46	46	7.4
Ave.	0.487	65	64	309	181	175	127	170	166	129	127	154	152	122	121	-
Flue Wash Effluent - 8 hr. composite																
May 20	Est. 0.26	3.66	2.49	3180	3060	1550	1510	2610	2600	1360	1360	2580	2580	1360	1360	6.0
21	"	1.79	1.14	5060	4930	2430	2370	4040	4030	2080	2080	4010	4010	1980	1980	3.1
22	"	0.99	0.57	2370	2230	1070	1030	2080	2080	1060	1030	2030	2030	1060	1060	3.5
26	"	0.56	0	7630	7510	2690	2640	6320	6320	2160	2160	6250	6250	2160	2160	6.4
27**	"	0.67	0	2560	2430	1140	1090	1580	1580	664	662	1520	1520	657	657	3.5
Ave.	Est. 0.26	1.53	0.84	4160	4030	1780	1730	3330	3320	1460	1460	3280	3280	1440	1440	-
Line #7 - 24 hr. composite																
May 20	3.30	55	54	166	148	140	97	120	115	100	97	105	103	91	90	7.5
21	3.57	67	66	286	153	130	70	95	88	72	70	81	77	71	70	7.4
22	-	54	54	479	342	237	198	173	169	141	138	118	116	95	94	8.3
26	3.82	73	72	304	190	234	181	142	141	139	139	124	124	124	124	7.7
27**	3.82	58	57	260	132	122	73	151	147	75	73	128	126	101	101	7.6
Ave***	3.63	63	62	282	156	156	105	127	123	96	95	110	108	97	96	-

* Grab sample

** Average values of waste constituents of raw water used to calculate net values.

*** Sample of May 22 not included in average for Line #7 (Volume assumed to be 3.63 MGD for purposes of computation.)

Table 2

AVERAGE AND DAILY, GROSS AND NET, QUANTITIES OF WASTE CONSTITUENTS
Lbs/Day

Environmental Health Center
Public Health Service
Cincinnati, Ohio

Port Huron Sulphite and Paper Company, Port Huron, Michigan

Date 1953	Flow MGD	BOD 5-day 20° C Lbs/Day		Total Solids Total Lbs/Day		Total Solids Volatile Lbs/Day		Suspended Solids Total Lbs/Day		Suspended Solids Volatile Lbs/Day		Settleable Solids Total Lbs/Day		Settleable Solids Volatile Lbs/Day	
		Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net	Gross	Net
Line #8 - 8 hr. composite															
May 20	0.430	194	190	958	535	355	201	273	255	212	201	237	230	226	222
21	0.373	293	289	1020	607	458	271	436	414	277	271	374	361	352	349
22	0.327	158	158	873	499	426	319	344	333	314	306	289	284	261	259
26	0.336	137	135	737	390	303	154	185	182	154	154	151	151	146	146
27	0.374	218	215	796	396	287	134	222	209	140	134	184	178	150	150
Average	0.368	200	197	877	485	366	216	292	279	219	213	247	241	227	225
Line #1 - 8 hr. composite															
May 20	1.33	144	133	1870	955	832	355	477	421	355	322	322	299	266	255
21	1.13	207	198	1750	500	802	236	320	255	245	226	179	141	150	141
22	1.05	88	88	1650	447	631	289	482	446	219	193	429	411	123	114
26	0.926	247	240	1470	510	757	345	402	394	363	363	309	309	294	294
27	1.05	201	193	1440	315	692	263	342	307	237	228	245	228	140	140
Average	1.10	177	170	1640	465	743	298	405	365	284	266	297	278	195	187
Line #3 - 8 hr. composite															
May 20	3.06	536	511	5000	1990	2040	945	1150	1020	820	740	536	485	511	485
21	3.07	564	538	5020	1610	1310	0	871	692	640	589	154	128	154	128
22	2.31	443	443	8480	5840	5010	4260	945	867	675	617	520	482	251	231
26	0.912	160	152	2770	1830	1520	1120	670	662	413	411	396	396	228	228
27	1.17	176	166	1820	566	762	283	664	624	351	332	459	439	146	146
Average	2.10	376	362	4620	2370	2130	1320	860	773	579	538	413	386	258	242

Table 2 (Cont'd) - 2

AVERAGE AND DAILY, GROSS AND NET, QUANTITIES OF WASTE CONSTITUENTS

Lbs/Day

Environmental Health Center
Public Health Service
Cincinnati, Ohio

Port Huron Sulphite and Paper Company, Port Huron, Michigan

Date 1953	Flow MGD	BOD 5-day 20° C Lbs/Day Gross	BOD 5-day 20° C Lbs/Day Net	Total Solids Total Lbs/Day Gross	Total Solids Total Lbs/Day Net	Total Solids Volatile Lbs/Day Gross	Total Solids Volatile Lbs/Day Net	Suspended Solids Total Lbs/Day Gross	Suspended Solids Total Lbs/Day Net	Suspended Solids Volatile Lbs/Day Gross	Suspended Solids Volatile Lbs/Day Net	Settleable Solids Total Lbs/Day Gross	Settleable Solids Total Lbs/Day Net	Settleable Solids Volatile Lbs/Day Gross	Settleable Solids Volatile Lbs/Day Net
Line #4 - 8 hr. composite															
May 20	0.475	325	321	1400	935	872	702	888	868	713	702	860	852	706	702
21	0.464	240	236	1130	616	620	387	697	670	395	387	627	612	391	387
22	0.476	183	183	1100	556	631	477	572	556	489	477	508	500	449	449
26	0.481	317	313	1520	1020	907	694	810	806	694	694	770	770	694	690
27	0.540	257	252	1090	514	514	293	451	433	302	293	315	306	207	207
Average	0.487	264	261	1250	728	709	511	684	667	519	511	616	608	489	486
Fine Wash Effluent - 8 hr. composite															
May 20 Est.	0.26	7.94	5.40	6900	6630	3360	3270	5660	5640	2960	2960	5590	5580	2950	2940
21	"	3.88	2.47	11,000	10,690	5270	5140	8760	8740	4510	4510	8690	8690	4290	4290
22	"	2.15	1.24	5140	4830	2320	2230	4510	4510	2300	2300	4400	4400	2300	2300
26	"	1.22	0	16500	16300	5830	5720	13700	13700	4680	4680	13600	13600	4680	4680
27	"	1.45	0	5550	5260	2470	2360	3430	3430	1440	1430	3300	3300	1420	1420
Average Est.	0.26	3.32	1.82	9030	8740	3860	3750	7220	7200	3170	3170	7120	7120	3120	3120
Line #7 - 24 hr. composite															
May 20	3.30	1510	1490	7330	4080	3860	2670	3300	3170	2750	2670	3080	3030	2510	2480
21	3.57	2000	1970	8520	4560	3870	2090	2830	2620	2140	2090	2410	2290	2120	2090
22	-														
26	3.82	2330	2300	10,000	6060	7460	5770	4530	4490	4430	4430	3950	3950	3950	3950
27	3.82	1850	1820	8290	4210	3890	2330	4810	4690	2390	2330	4080	4020	3220	3220
Average	3.63	1920	1900	8540	4730	4770	3220	3870	3740	2930	2880	3380	3320	2950	2930

Supplement

to

Industrial Waste Survey

at

Port Huron Sulphite and Paper Company

Black River Study

May 15 and 18, 1953

BLACK RIVER STUDY

Introduction

At the request of the Michigan Water Resources Commission a short survey of the Black River was conducted by the personnel of the U.S. Public Health Service. The survey was carried out concurrently with the industrial waste survey at the Port Huron Sulphite and Paper Company. This project was also part of the continuing study of boundary waters pollution being conducted for the International Joint Commission.

Description of The Black River

The Black River is the largest tributary draining into the St. Clair River, which is a water way connecting Lake Huron and Lake St. Clair. Black River drains an area of 690 square miles. The main stem is about 60 miles long and falls about 200 feet from its source to the mouth.

An artificial canal was constructed in 1912 between Lake Huron and the Black River to provide flushing and diluting water for relieving nuisance conditions in the lower Black River. This canal is about 6000 feet long, 50 feet wide, and 8 feet in depth. In 1930, back water gates were installed at the Lake Huron end to prevent a reversal of flow into the lake resulting from flood or other unusual conditions in the Black River.

Object of The Survey

The object of this survey was to spot check the water quality of the Black River below and immediately above the Port Huron Sulphite and Paper Company.

Survey Dates

Samples were collected on two days, May 15 and 18, 1953.

Sampling Procedures

The interest in this survey centered along a very limited reach of the Black River, from the mouth of the river to the north end of the city of Port Huron.

Three sampling stations were selected. One at the Scott Avenue Bridge upstream from the Port Huron Sulphite and Paper Company plant. The other two were downstream from the plant. One was at the 10th Avenue Bridge and the other was nearer to the mouth of the river at the Military Street Bridge.

All samples were grab samples and were collected at mid-depth of the stream.

At the Scott Avenue Bridge the samples were collected from mid stream.

At the 10th Avenue Bridge, samples at the quarter-points were collected in addition to the mid stream samples.

At the Military Street Bridge, samples were collected at the third-points.

The samples were transported to the mobile laboratory at Wyandotte immediately after collection. The D.O. samples were fixed in the field.

The sample collector recorded the time of day when a sample was collected, determined the temperature of the water to the nearest degree centigrade, and recorded as "remarks" any unusual stream conditions.

During the periods of the river sampling, there was no observable flow in the large sewer at McPherson Street which has an outlet to the Black River a short distance downstream from the Scott Avenue Bridge.

The flow in the sewer outlet located across the stream (on the south shore) from Line No. 7 outfall of the Port Huron Sulphite and Paper Co. plant appeared to be normal during periods of sampling.

Laboratory Determinations

Laboratory determinations of the river samples included dissolved oxygen, biochemical oxygen demand, suspended solids, and pH.

Analyses were made in accordance with procedures given in the "Standard Methods for Examination of Water and Sewage", Ninth Edition (1946).

Flow Measurements

Stream flows in the Black River for the two days in which samples were collected are to be estimated using hydrological data for the drainage area.

CONCENTRATIONS OF WASTE CONSTITUENTS
BLACK RIVER
PPM
GRAB SAMPLES

Date 1953	Temp. °C	Dissolved Oxygen ppm	Dissolved Oxygen % Sat.	B.O.D. 5-day ppm	Suspended Solids Total ppm	Suspended Solids Volatile ppm	pH
Scott Avenue Bridge - Upstream from Port Huron Sulphite and Paper Co.							
Center of Black River							
May 15	15	8.9	88	1.8	27	8	8.2
18	13	8.7	82	2.0	26	8	8.1
Average	14	8.8	85	1.9	26.5	8	-
10th Avenue Bridge - Downstream From Plant 1/4 Point From N Shore *							
May 15	15	8.4	82	3.9	20	9	8.1
18	13	8.7	82	3.6	28	10	8.0
Average	14	8.55	82	3.75	24	9.5	-
Center of River							
May 15	15	8.3	81	3.1	24	11	8.1
18	12	8.3	76	3.7	28	9	8.0
Average	13.5	8.3	78	3.4	26	10	-
3/4 Point From N. Shore*							
May 15	15	8.5	84	3.2	23	9	8.1
18	12	8.5	78	3.3	27	8	8.0
Average	13.5	8.5	81	3.25	25	8.5	-
Military Street Bridge-Downstream From 10th Avenue Bridge							
1/3 Point From N. Shore*							
May 15	15	6.8	67	3.2	29	10	7.9
18	13	8.0	75	5.4	23	9	7.9
Average	14	7.4	71	4.3	26	9.5	-
2/3 Point From N. Shore*							
May 15	15	6.9	68	2.8	30	10	7.9
18	13	8.1	76	4.4	23	9	7.9
Average	14	7.5	72	3.6	26.5	9.5	-

* Plant located on north shore of river.